



The Human Immunodeficiency Virus Continuum of Care in European Union Countries in 2013

Data and Challenges

Gourlay, Annabelle; Noori, Teymur; Pharris, Anastasia; Axelsson, Maria; Costagliola, Dominique; Cowan, Susan; Croxford, Sara; d'Arminio Monforte, Antonella; Del Amo, Julia; Delpech, Valerie; Díaz, Asunción; Girardi, Enrico; Gunsenheimer-Bartmeyer, Barbara; Hernando, Victoria; Jose, Sophie; Leierer, Gisela; Nikolopoulos, Georgios; Obel, Niels; Op de Coul, Eline; Paraskeva, Dimitra; Reiss, Peter; Sabin, Caroline; Sasse, André; Schmid, Daniela; Sonnerborg, Anders; Spina, Alexander; Suligoi, Barbara; Supervie, Virginie; Touloumi, Giota; Van Beckhoven, Dominique; van Sighem, Ard; Vourli, Georgia; Zangerle, Robert; Porter, Kholoud; European HIV Continuum of Care Working Group

Published in:
Clinical Infectious Diseases

DOI:
[10.1093/cid/cix212](https://doi.org/10.1093/cid/cix212)

Publication date:
2017

Document version
Publisher's PDF, also known as Version of record

Document license:
[CC BY-NC-ND](#)

Citation for published version (APA):
Gourlay, A., Noori, T., Pharris, A., Axelsson, M., Costagliola, D., Cowan, S., Croxford, S., d'Arminio Monforte, A., Del Amo, J., Delpech, V., Díaz, A., Girardi, E., Gunsenheimer-Bartmeyer, B., Hernando, V., Jose, S., Leierer, G., Nikolopoulos, G., Obel, N., Op de Coul, E., ... European HIV Continuum of Care Working Group (2017). The Human Immunodeficiency Virus Continuum of Care in European Union Countries in 2013: Data and Challenges. *Clinical Infectious Diseases*, 64(12), 1644-1656. <https://doi.org/10.1093/cid/cix212>

The Human Immunodeficiency Virus Continuum of Care in European Union Countries in 2013: Data and Challenges

Annabelle Gourlay,¹ Teymur Noori,² Anastasia Pharris,² Maria Axelsson,³ Dominique Costagliola,⁴ Susan Cowan,⁵ Sara Croxford,⁶ Antonella d'Arminio Monforte,⁷ Julia del Amo,⁸ Valerie Delpech,⁶ Asunción Díaz,⁸ Enrico Girardi,⁹ Barbara Günsheimer-Bartmeyer,¹⁰ Victoria Hernando,⁸ Sophie Jose,¹ Gisela Leierer,¹¹ Georgios Nikolopoulos,^{12,13} Niels Obel,¹⁴ Eline Op de Coul,¹⁵ Dimitra Paraskeva,¹³ Peter Reiss,^{16,17} Caroline Sabin,¹ André Sasse,¹⁸ Daniela Schmid,¹⁹ Anders Sonnerborg,²⁰ Alexander Spina,¹⁹ Barbara Suligoi,²¹ Virginie Supervie,⁴ Giota Touloumi,²² Dominique Van Beckhoven,¹⁸ Ard van Sighem,¹⁶ Georgia Vourli,²² Robert Zangerle,¹¹ and Kholoud Porter,¹ for the European HIV Continuum of Care Working Group

¹University College London, United Kingdom; ²European Centre for Disease Prevention and Control, and ³Public Health Agency of Sweden, Solna; ⁴Sorbonne Universités, UPMC Université Paris 06, INSERM, Institut Pierre Louis d'Epidémiologie et de Santé Publique (IPLESP UMR_S 1136), Paris, France; ⁵Statens Serum Institut, Copenhagen, Denmark; ⁶Public Health England, London, United Kingdom; ⁷ASST Santi Paolo e Carlo University Hospital, Milan, Italy; ⁸Centro Nacional de Epidemiología, Instituto de Salud Carlos III, Madrid, Spain; ⁹Istituto Nazionale Malattie Infettive 'L. Spallanzani', Rome, Italy; ¹⁰Robert Koch Institute, Berlin, Germany; ¹¹Medical University Innsbruck, Austria; ¹²Medical School, University of Cyprus, Nicosia; ¹³Hellenic Center for Disease Control and Prevention, Amarousio, Greece; ¹⁴Rigshospitalet, Copenhagen University, Denmark; ¹⁵National Institute for Public Health and the Environment, Bilthoven; ¹⁶Stichting HIV Monitoring, Amsterdam, and ¹⁷Academic Medical Center, Amsterdam, The Netherlands; ¹⁸Scientific Institute of Public Health, Brussels, Belgium; ¹⁹Austrian Agency for Health and Food Safety, Vienna; ²⁰Karolinska Institutet and Karolinska University Hospital, Stockholm, Sweden; ²¹National AIDS Unit, Istituto Superiore di Sanità, Rome, Italy; and ²²Medical School, National and Kapodistrian University of Athens, Greece

Background. The Joint United Nations Programme on HIV/AIDS (UNAIDS) has set a “90-90-90” target to curb the human immunodeficiency virus (HIV) epidemic by 2020, but methods used to assess whether countries have reached this target are not standardized, hindering comparisons.

Methods. Through a collaboration formed by the European Centre for Disease Prevention and Control (ECDC) with European HIV cohorts and surveillance agencies, we constructed a standardized, 4-stage continuum of HIV care for 11 European Union countries for 2013. Stages were defined as (1) number of people living with HIV in the country by end of 2013; (2) proportion of stage 1 ever diagnosed; (3) proportion of stage 2 that ever initiated ART; and (4) proportion of stage 3 who became virally suppressed (≤ 200 copies/mL). Case surveillance data were used primarily to derive stages 1 (using back-calculation models) and 2, and cohort data for stages 3 and 4.

Results. In 2013, 674 500 people in the 11 countries were estimated to be living with HIV, ranging from 5500 to 153 400 in each country. Overall HIV prevalence was 0.22% (range, 0.09%–0.36%). Overall proportions of each previous stage were 84% diagnosed, 84% on ART, and 85% virally suppressed (60% of people living with HIV). Two countries achieved $\geq 90\%$ for all stages, and more than half had reached $\geq 90\%$ for at least 1 stage.

Conclusions. European Union countries are nearing the 90-90-90 target. Reducing the proportion undiagnosed remains the greatest barrier to achieving this target, suggesting that further efforts are needed to improve HIV testing rates. Standardizing methods to derive comparable continuums of care remains a challenge.

Keywords. HIV infection; continuum of care; surveillance; cohort analysis; antiretroviral therapy.

The human immunodeficiency virus (HIV) continuum of care is a public health monitoring tool to conceptualize the care pathway that people living with HIV (PLHIV) progress

through: diagnosis of HIV infection, linkage to and retention in HIV care, initiation of and adherence to antiretroviral therapy (ART), and suppression of viremia [1]. This concept has increasingly been adopted to evaluate HIV program performance. Four stages of the HIV continuum can also be used to monitor the Joint United Nations Programme on HIV/AIDS (UNAIDS) “90-90-90” target (90% of PLHIV diagnosed, 90% of those diagnosed on ART, 90% of those on treatment virally suppressed), which aims to curb the HIV epidemic by 2020 [2].

However, challenges with data quality, appropriate data sources, and the absence of standardized definitions have hampered comparisons across countries. An initiative led by the European Centre for Disease Prevention and Control (ECDC)

Received 23 December 2016; editorial decision 16 February 2017; accepted 13 March 2017; published online March 20, 2017.

Correspondence: A. Gourlay, Department of Infection and Population Health, Faculty of Population Health Sciences, University College London, Mortimer Market Centre, off Capper Street, London WC1E 6JB, UK (a.gourlay@ucl.ac.uk).

Clinical Infectious Diseases® 2017;64(12):1644–56

© The Author 2017. Published by Oxford University Press for the Infectious Diseases Society of America. This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs licence (<http://creativecommons.org/licenses/by-nc-nd/4.0/>), which permits non-commercial reproduction and distribution of the work, in any medium, provided the original work is not altered or transformed in any way, and that the work is properly cited. For commercial re-use, please contact journals.permissions@oup.com. DOI: 10.1093/cid/cix212

in 2014 to monitor the Dublin Declaration on Partnership to Fight HIV/AIDS in Europe and Central Asia identified that many European countries lacked data for some, or all, continuum stages [3, 4]. This study, as well as a recent systematic review, concluded that, although many continuum estimates are being published, their comparability is limited by differences in data sources and methods used [3, 5].

Collaborations between public health surveillance and national clinical cohorts, where the latter exist, could help address gaps in data availability. The key advantage of using longitudinal clinical cohort data lies in their potential to enhance the internal consistency of care continuums by using the same group of individuals, defined as “denominator-denominator linkage” [6], to analyze multiple stages. While the ideal continuum will maximize the number of stages with denominator-denominator linkage, additional data from HIV case surveillance systems are necessarily required to provide information on the diagnosed population, and as modeling inputs to estimate the total number of PLHIV.

We, therefore, aimed to construct a 4-stage standardized continuum of HIV care for 11 European countries using HIV case surveillance and national clinical cohort data. We assess the utility of using cohort data and describe the challenges encountered.

METHODS

Selection of Countries and Cohorts

HIV cohorts were drawn from EuroCoord (www.EuroCoord.net), a European Union (EU)–funded Network of Excellence

that includes most European HIV cohorts [7, 8]. Only cohorts considered national—that is, multicenter and not restricted by risk group—were included. HIV cohorts and surveillance agencies in Austria, Belgium, Denmark, France, Germany, Greece, Italy, the Netherlands, Spain, Sweden, and the United Kingdom took part (Supplementary Data 1).

Standardized Definitions and Data Sources

Continuums of HIV care were constructed for each country using national-level HIV case surveillance data and HIV clinical cohort data. Four stages of the continuum of HIV care were estimated for 2013, the most recent year of data available (Table 1).

Stage 1: Number of PLHIV

Stage 1 was defined as the estimated total number of PLHIV in each country by the end of 2013. Those who had died or out-migrated were excluded where possible. Several countries had no out-migration data or could only make assumptions about the proportion who out-migrated (Supplementary Data 2).

Where feasible, back-calculation models that estimate HIV incidence and the undiagnosed fraction from routinely collected HIV case surveillance data were used. For consistency, PLHIV estimates generated using a back-calculation modeling tool developed by the ECDC [9] were prioritized. Five countries used the ECDC Modelling Tool “incidence method” [10]. If this was not appropriate (eg, due to incomplete case surveillance data), similar back-calculation methods tailored to countries’ own data were used (4 countries), either to estimate the

Table 1. Standardized Definitions Used to Estimate the Human Immunodeficiency Virus Continuum of Care

Stage	Definition	Data Source	Analysis and Estimation Approaches
(1) People living with HIV	Number of people living with HIV (diagnosed and undiagnosed) in each country by the end of 2013	HIV case surveillance data if available, or cohort data otherwise	Back-calculation models to estimate HIV incidence and the undiagnosed fraction (ECDC HIV Modelling Tool [9], 5 countries ^a ; other models, 4 countries ^b), otherwise Multi-Parameter Evidence Synthesis (United Kingdom), or other surveillance/survey-based estimates (Sweden).
(2) Diagnosed	Proportion of (1) ever diagnosed	HIV case surveillance data if available, or cohort data otherwise	Cumulative number of diagnosed by end of 2013, excluding out-migrations and deaths before the end of 2013 if feasible (3 countries ^c using surveillance data, 3 countries ^d using national cohort data). Otherwise, the diagnosed population was estimated using: ECDC HIV Modelling Tool (Austria, Belgium), statistical modeling (Spain), combining estimates of the population in care/ not in care (France), or clinic-based surveys (Italy).
(3) ART	Proportion of (2) who ever initiated ART (regardless of treatment guidelines, antiretroviral drug regimens or number of drugs, treatment interruptions, or discontinuations)	Country-specific HIV cohorts	Descriptive statistics. Patients lost to follow-up to the cohort (ART/viral load status unknown) were excluded to give a high estimate, and included (assumed never on ART, where ART status unknown) in the low estimate. The preferred estimate was taken as the midpoint.
(4) Virally suppressed	Proportion of (3) who were virally suppressed (≤ 200 copies/mL or below the level of detection of the assay) at last visit (1 July 2012 to 31 December 2013) ^e	Country-specific HIV cohorts	As above. Patients lost to follow-up to the cohort with no recent viral load measurements were assumed to be unsuppressed in the low estimate.

Abbreviations: ART, antiretroviral therapy; ECDC, European Centre for Disease Prevention and Control; HIV, human immunodeficiency virus.

^aAustria, Belgium, Denmark, Greece, the Netherlands.

^bFrance, Germany, Italy, Spain.

^cGermany, Greece, United Kingdom.

^dDenmark, the Netherlands, Sweden.

^eSix months of 2012 were included to allow for delays in updating cohort records.

total number of PLHIV directly, or to estimate the undiagnosed population, combined with surveillance or survey-based estimates of the diagnosed population [11–13]. Otherwise, alternative approaches included multiparameter evidence synthesis incorporating case surveillance and prevalence survey data (1 country) [14], or surveillance/survey-based estimates (1 country) (Supplementary Data 2).

Where feasible, 95% confidence intervals (CIs) were calculated using bootstrapping techniques. Adult prevalence was calculated using Eurostat population denominators for 2013 [15], excluding children <15 years.

Stage 2: Proportion Diagnosed

Stage 2 was defined as the proportion of all PLHIV, estimated as above, ever diagnosed, excluding deaths and out-migrations (Supplementary Data 2).

Ideally, the diagnosed population was derived from cumulative HIV case surveillance data to the end of 2013 (3 countries). Where this was not feasible (eg, surveillance systems that started recently or changed over time in geographic coverage), alternative approaches were used. These included estimating the diagnosed fraction from the ECDC HIV Modelling Tool (2 countries); combining estimates of the diagnosed population in care and not in care by triangulating data sources (1 country) [16]; use of national cohort data—that is, the number of patients diagnosed and in care, where linkage to care is expected to be extremely high (3 countries); statistical modeling using recent HIV case surveillance data to estimate new HIV diagnoses for all years (1 country); or infectious disease clinic survey-based estimates (1 country) [17].

A range of uncertainty was calculated by dividing the number diagnosed by the lower/upper confidence limits for the number of PLHIV, to reflect the uncertainty in estimating stage 1.

Stage 3: Proportion on ART

Stage 3 was defined as the proportion of those diagnosed, as above, who have ever initiated ART, regardless of prevailing treatment guidelines, antiretroviral regimens or number of drugs, or treatment interruptions or discontinuations. This definition was applied to country-specific cohort datasets. Patients known to have died or out-migrated by the end of 2013 were excluded, as were patients with unknown year of diagnosis if it was unclear they were diagnosed before the end of 2013. Those with unknown ART status or unknown year of ART initiation were assumed to be untreated by the end of 2013.

Minimum and maximum estimates were calculated based on assumptions about patients lost to follow-up (LTFU) to the cohort and whether they were likely to be receiving care in noncohort centers, or lost to care entirely and, therefore, likely not on ART and unsuppressed. For the maximum estimate, patients LTFU were excluded, and for the minimum estimate they were included and assumed to be untreated, unless their

records indicated ART initiation. LTFU was defined as no clinic interaction 1 July 2012–31 December 2013 and, therefore, no ART or viral load (VL) data. Clinic interaction was based on any laboratory measurement, drug start date, or other evidence of an HIV clinic visit. The preferred estimate was the midpoint between the minimum and maximum estimate.

Stage 4: Proportion Virally Suppressed

Stage 4 was defined as the proportion of those ever on ART, as above, with a VL measurement ≤ 200 HIV RNA copies/mL, or below the assay detection limit, at their last visit 1 July 2012–31 December 2013. This VL threshold was chosen to allow for improvements over time in the lower limit of detection of the assay. Cohort data were used to calculate minimum and maximum estimates, and the midpoint between the 2. Patients LTFU (ie, no recent VL measurements) were excluded for the maximum estimate and included for the minimum estimate (assumed to be unsuppressed). Patients with no VL measurements 1 July 2012–31 December 2013, but classified as engaged in care based on other laboratory measurements, drug start dates, or clinic visits were assumed to be adherent to ART and suppressed.

Construction of Combined Regional Estimates

Country-level results were compiled and combined, and weighted averages calculated for each stage to construct a summary continuum for the region based on all 11 countries (Supplementary Data 3). Percentages were calculated using the previous stage as the denominator, as well as using a single denominator of PLHIV.

Ethical Approval

All participating clinical cohorts obtained ethics approvals from local ethics committees, national data agencies, or institutional review boards. Informed consent of patients was sought in accordance with national regulations. Surveillance data are collected under the authority of the public health agencies that abide with strict confidentiality and privacy data protection laws.

RESULTS

Continuum of HIV Care Estimates by Country

National estimates for the total number of PLHIV by the end of 2013 ranged from 5500 in Denmark to 153 400 in France, corresponding to a prevalence of 0.12% and 0.29%, respectively (Table 2). Prevalence was lowest in Austria and Sweden (both 0.09%), and highest in Spain (0.36%).

There was variation across the countries in the proportions estimated for each stage. In 2013, of all PLHIV, the proportions diagnosed ranged from 78% in Greece to 91% in Denmark, with 2 other countries (Italy and Sweden) also reaching $\geq 90\%$, and Austria just below this threshold at 88%. Of those diagnosed,

Table 2. Estimates for 4 Stages of the Human Immunodeficiency Virus Continuum of Care for 2013, by Country

Country	(1) No. PLHIV (95% CI)	HIV Prevalence ^a	(2) Diagnosed (Estimated Range) ^b	(3) Ever on ART (Min, Max Estimate)	(4) Suppressed (Min, Max Estimate)	Suppressed of All PLHIV
Austria	6500 (6300–6700) ^c	0.09%	88% (86%–91%)	90% (85%, 94%)	84% (76%, 91%)	66%
Belgium	18 000 (17 700–18 300)	0.19%	84% (83%–85%)	96% (96%, 96%)	82% (77%, 87%)	66%
Denmark	5500 (5000–6000) ^d	0.12%	91% (83%–100%)	94% (93%, 94%)	93% (93%, 93%)	80%
France	153 400 (150 600–155 900)	0.29%	84% (82%–85%)	93% ^e	92% ^e	72%
Germany	80 000 (69 000–91 000)	0.11%	83% (73%–96%)	87% (83%, 90%)	81% (69%, 92%)	58%
Greece	14 200 (13 700–14 600)	0.15%	78% (76%–81%)	82% (79%, 84%)	81% (72%, 89%)	52%
Italy	128 100 (122 400–133 500) ^f	0.25%	90% (86%–94%)	80% (75%, 85%)	82% (74%, 90%)	59%
The Netherlands	22 000 (21 400–22 800)	0.16%	85% (82%–88%)	91% (90%, 92%)	91% (88%, 94%)	70%
Spain	140 700 (128 200–155 200)	0.36%	82% (78%–86%) ^g	76% (73%, 78%)	81% (72%, 89%)	50%
Sweden	7000 ^h	0.09%	90% ^h	92% (92%, 92%)	93% (93%, 93%)	77%
United Kingdom	99 100 (93 000–107 400)	0.19%	81% (75%–87%) ⁱ	82% (76%, 88%)	82% (70%, 94%)	54%

Percentages shown for stages 2, 3, and 4 are out of the previous stage. Percentages in the final column are calculated out of the total PLHIV (1). Estimates were constructed using standardized methods and may differ from previously published results and official national statistics due to differences in data sources, definitions, and time periods [20–24].

Abbreviations: ART, antiretroviral therapy; CI, confidence interval; HIV, human immunodeficiency virus; PLHIV, people living with human immunodeficiency virus.

^aAdult HIV prevalence was estimated by dividing the number of PLHIV by Eurostat population denominators for adults aged ≥15 years in 2013.

^bEstimated ranges for the percentage diagnosed were calculated by dividing the number diagnosed by the upper and lower confidence limits for stage 1 (PLHIV), to reflect the uncertainty in the estimate for stage 1, unless otherwise indicated.

^cEstimate for PLHIV generated using Austrian cohort data, which cover approximately 76% of people living with HIV in Austria.

^dEstimated range (CI not available), informed by the ECDC Modelling Tool and triangulation with other estimates.

^eMinimum estimates are not applicable due to the methodology and data sources used to derive the population in care in France. Upper estimates were used to substitute the (missing) minimum estimates when calculating the combined estimates for the proportion on ART and proportion virally suppressed in the 11 European Union countries.

^fRange for PLHIV in Italy calculated using the 95% CI for the undiagnosed estimate and, separately, a range of uncertainty for the number diagnosed and lost from care.

^gThe 95% CI, reflecting the uncertainty in estimating the diagnosed population nationally in Spain, using a statistical model.

^hSurveillance and survey-based estimate for PLHIV; CIs were therefore not available for the estimate of PLHIV, nor was a range available for the diagnosed estimate. However, in Sweden, the number diagnosed is reliably estimated from the national cohort and surveillance data, for which there is no under- or delayed reporting. Point estimate of 7000 PLHIV used to substitute the (missing) upper and lower limit when calculating the overall range for the percentage diagnosed in the 11 European Union countries combined.

ⁱAbsolute number diagnosed in the United Kingdom is reliably derived from national surveillance data. The range presented reflects the uncertainty in the estimate for stage 1.

the proportions on ART range from 76% in Spain to 96% in Belgium. Five other countries (Austria, Denmark, France, the Netherlands, and Sweden) achieved ≥90% on ART. There was less variation between countries in the proportions virally suppressed. Of those on ART, the proportions virally suppressed were ≥81% in all countries, with the highest proportion estimated at 93% in both Denmark and Sweden. France and the Netherlands also achieved ≥90% virally suppressed. Only 2 countries, Denmark and Sweden, achieved ≥90% for each of the 3 continuum stages using our standardized definitions. Of the total PLHIV, Denmark and Sweden reached ≥73% virally suppressed, with France and the Netherlands nearing this target, at 72% and 70%, respectively.

Combined Estimates for the European Region (11 EU Countries)

Overall, 674 500 people were estimated to be living with HIV in the 11 EU countries by the end of 2013 (prevalence = 0.22%). Overall, the proportions at each stage were 84% of PLHIV diagnosed (79%–90%); 84% of those diagnosed on ART (81%–87%); and 85% of those on ART with viral suppression (76%–91%) (Figure 1). Of the total PLHIV, 60% were estimated to be virally suppressed. The greatest drop between successive stages of the continuum was observed between the number of PLHIV and the number diagnosed, with 16% of undiagnosed individuals falling out of the continuum.

DISCUSSION

The 11 EU countries included in this study, constituting roughly three-quarters of the EU population and three-quarters of HIV diagnoses in the EU in 2005–2014 [18], are nearing the UNAIDS 90-90-90 target, well ahead of 2020. Although few

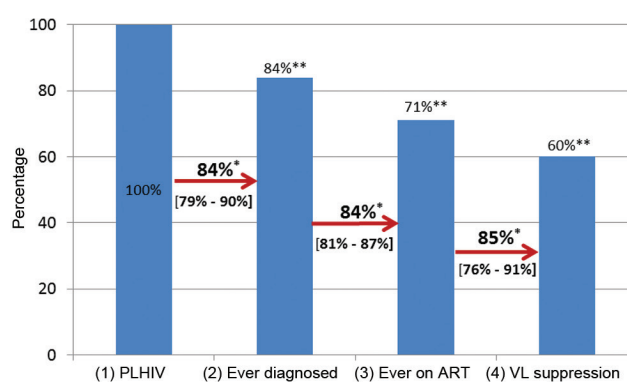


Figure 1. Continuum of human immunodeficiency virus (HIV) care in 11 European countries (Austria, Belgium, Denmark, France, Germany, Greece, Italy, The Netherlands, Spain, Sweden, and United Kingdom) for 2013. Weighted averages, accounting for the number of HIV-infected individuals at each stage in each country, were taken across all countries for each stage. *Percentages out of the previous stage. **Percentages among all people living with HIV by the end of 2013. Abbreviations: ART, antiretroviral therapy; PLHIV, people living with human immunodeficiency virus; VL, viral load.

countries achieved $\geq 90\%$ for each stage, based on our standardized definitions, more than half had reached, or were close to, the target for at least 1 stage. Further improvements are also expected to have occurred since 2013, following recent changes in treatment guidelines [19]. However, reducing the undiagnosed proportion remains the biggest barrier to achieving this goal, with the largest drop between successive stages of the continuum observed at this first stage. To our knowledge, this is the first attempt to standardize definitions and derive continuum of care estimates for the EU. Our estimates may differ from previously published results and official national statistics due to differences in data sources, definitions, and time periods, although these differences are relatively minor [20–25].

UNAIDS estimates for the number of PLHIV in 2013, derived using Spectrum/EPP software with HIV prevalence data and most suitable for countries with generalized epidemics [26], were only reported for 4 of the countries in our study [27]. Our estimates, based primarily on back-calculation modeling and routinely collected HIV case surveillance data, strengthen data availability for this stage and provide valuable information for HIV program monitoring and planning. We observed the highest HIV burden in France, Spain, Italy, and the United Kingdom, accounting for the majority of PLHIV in this region, concurring with earlier reports [27].

Losses from the continuum occurred between all stages, but were greatest between stages 1 and 2. Overall, 16% of PLHIV were undiagnosed, indicating that further efforts are required to improve HIV testing rates, particularly among most at-risk populations. Late presentation remains a major concern in Europe, with around half of new diagnoses presenting with a CD4 count < 350 cells/ μL [18, 28]. A systematic review published in 2011 suggested that rapid testing and counseling in community settings, community-based peer counseling campaigns, and expansion of opt-out testing policies may be effective interventions to improve HIV testing rates in men who have sex with men in high-income countries [29]. Provision of rapid HIV tests in pharmacies [30], and provider-initiated HIV testing in general practice or individuals presenting with indicator conditions [31, 32], may offer further opportunities to increase testing uptake. Widening legislation for and increasing access to self-testing and self-sampling are likely to increase testing, but must be coupled with channels for linkage to care [21].

The lowest proportions of diagnosed individuals on ART were estimated in Spain, Italy, Greece, and the United Kingdom. National treatment guidelines are likely to play a key role here. For example, in 2013, treatment guidelines in Greece, Spain, and the United Kingdom recommended ART initiation in patients with CD4 counts of ≤ 350 cells/ μL . The proportion on ART is expected to improve once the recent changes in guidelines [19] are implemented. Lack of, or delayed, linkage to care following HIV diagnosis is a possible explanation. Although patients in high-income countries are usually linked to care

within 3 months of diagnosis, delays among specific subgroups have been reported [16, 33]. Failure to achieve viral suppression after starting ART may reflect poor adherence, treatment interruptions or discontinuations, or insufficient time to achieve suppression for those recently initiating ART [16].

Increasing awareness of the continuum of care—for example, through national treatment and/or service delivery guidelines—and providing evidence-based recommendations to improve the testing and care environment, may also improve the care continuum [34].

These results must be interpreted in light of several key methodological challenges encountered. Use of the HIV Modelling Tool [9] facilitated the standardization of estimates for PLHIV, but applying the same approach to countries with different HIV surveillance systems was not always possible due to insufficient historical case surveillance data availability in some countries. Triangulation of data sources provides one possible solution, for example, summing estimates of the undiagnosed population with cohort or survey-based estimates of the diagnosed population in care/not in care [12].

Difficulties capturing out-migration or linking surveillance or cohort datasets to population migration and death registries were additional challenges. Misclassification of vital status or out-migration will potentially overestimate the number still alive and living in a country. Few countries in our study had access to reliable out-migration data (Supplementary Data 2), with linkage to population registries usually precluded by the lack of unique identifiers. Where possible, adjustments were made using estimated levels of out-migration. In the long term, efforts to improve the recording of vital status and out-migration in surveillance databases, as well as linkage to registries via unique identifiers, are needed. In some cases, lack of reliable in-migration data also complicated modeling of HIV incidence and the separating of earlier infections from new infections occurring after arrival within the country.

Estimating proportions using cohorts that are not representative of the diagnosed population nationally may introduce bias, so efforts are required to understand and correct for this. The cohorts in our study were large, including national cohorts with near complete coverage of the diagnosed population, and were fairly representative (Supplementary Data 1) [35]. Nevertheless, estimates from cohorts with low coverage should be interpreted with caution. Ideally, estimates derived using cohort data would be adjusted by calculating and applying weights based on the distribution of demographic variables in cohort and surveillance datasets [35].

Patients LTFU in cohort data present another challenge—namely, the assumptions that are made about whether they are still in care, taking ART and virally suppressed, or truly lost from care and unsuppressed. Assuming all have been lost from care entirely would underestimate retention in care and the proportion suppressed, as suggested by a clinical audit in the

United Kingdom [36]. Ideally cohorts would collect and update data on patients who transfer to other clinics, although this is challenging in practice. In the absence of reliable patient transfer data, plausible limits should be calculated based on varying assumptions, as we have done, with the true value likely to lie between these limits.

There were several strengths and limitations to this study. Collaborations formed between cohort investigators and surveillance agencies facilitated the construction of HIV continuums from PLHIV to viral suppression. We attempted to standardize methods to enhance comparability between countries, and to generate summary estimates for the region. However, complete standardization was not possible, given the different limitations in data availability and quality in each country, as well as inherent differences in cohort inclusion criteria. For example, the Italian and Spanish cohorts require participants to be ART-naïve at baseline (Supplementary Data 1). Although the use of cohort data improved the internal consistency of the estimates, we were unable to link surveillance and cohort datasets in most countries to maximize internal consistency. For some countries we were unable to distinguish between those diagnosed and those linked to care (ie, enrolled in a cohort), although linkage to care is expected to be very high.

Additionally, our cross-sectional definitions do not address the timeliness of reaching each stage, or time spent at each stage, for example, time since starting ART [16]. Using a single VL measurement may also overestimate durable viral suppression [37]. However, our definitions provide a snapshot of the continuum in 2013 that is simple to interpret and communicate to policy makers. Treatment discontinuations or interruptions were not accounted for, which may result in overestimating the proportion “on ART.” However, a sensitivity analysis conducted for a few countries, restricting the definition of “on ART” to a record of ART between 1 July 2012 and 31 December 2013, made little difference to the overall proportions of PLHIV who were virally suppressed.

Finally, our study omitted 17 EU countries, mainly from Eastern and Central Europe as national cohort data were lacking, and, as such, estimates for the whole EU region may be lower than those presented here.

CONCLUSIONS

The 11 EU countries in our study are nearing the UNAIDS 90-90-90 target, with more than half having achieved $\geq 90\%$ for 1 or more stages of the continuum. The main barrier to achieving this goal appears to be reducing the proportion undiagnosed. These data provide useful comparisons to governments and healthcare planners, but must be interpreted in context of the limitations and key challenges above, as well as cohort and country differences. Challenges remain in constructing and standardizing the continuum of care for all stages. Enhancements to data sources and methods are required to

derive accurate estimates for national-level continuums of care, to facilitate comparisons between countries, and to generate regional and global estimates.

Supplementary Data

Supplementary materials are available at *Clinical Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

Notes

Acknowledgments. We thank all of the participants who took part in cohort studies in each country. We also thank Andrew J. Amato-Gauci, head of the European Centre for Disease Prevention and Control (ECDC) Disease Programme on HIV, Sexually Transmitted Infections and Viral Hepatitis for his support, and acknowledge the work of the following individuals who contributed to analyses and/or data management support: Matthias an der Heiden, Torsten Berglund, Iuri Fanti, David Jaminé, Christian Kollan, Laurence Lièvre, Alessia Mammone, Lise Marty, Olivier Nuñez, Patrizio Pezzotti, Vincenza Regine, and Alessandro Tavelli. Additional acknowledgements for each cohort are detailed in the [appendix](#).

Disclaimer. The views expressed in this manuscript are those of the researchers and not necessarily those of their respective funding agencies.

Financial support. This work was supported by the European Centre for Disease Prevention and Control (contract number ECD.5661).

Potential conflicts of interest. D. C. was a member of the French Gilead HIV board up to 2015; in the past 3 years, gave lectures for Janssen-Cilag, Merck Sharp & Dohme-Chibret, and ViiV and received travel/accommodations/meeting expenses from Gilead, ViiV, and Janssen-Cilag; conducted postmarketing studies for Janssen-Cilag, Merck Sharp & Dohme-Chibret, and ViiV; and is currently a consultant of Innavirvax. S. Cr. has received consultancy fees from the ECDC. A. d. M. has served as a board member for AbbVie, Bristol-Myers Squibb (BMS), Gilead Sciences, ViiV Healthcare, and Janssen, and her institution has received grant support from Gilead Sciences. J. d. A. has received research funding from ViiV Healthcare, MSD, and Gilead Sciences. E. G. has received grant support from Gilead Sciences, consultancy fees from Otsuka Novel Products and Janssen, fees for educational activity from Gilead Sciences and Janssen, and travel grants from Janssen. A. G. has served on an advisory board for ViiV Healthcare. S. J. has received speaker's fees from Gilead Sciences. K. P. has served on advisory boards for ViiV Healthcare. T. N. and A. P. are employed by the ECDC. N. O. has received unconditional research grants from Gilead Sciences, GlaxoSmithKline (GSK), Janssen, BMS, and Boehringer Ingelheim, paid to his institution. P. R. through his institution has received independent scientific grant support from Gilead Sciences, Janssen Pharmaceuticals, Merck & Co, BMS, and ViiV Healthcare; has served on a scientific advisory board for Gilead Sciences and a data safety monitoring committee for Janssen Pharmaceuticals; and has chaired a scientific symposium by ViiV Healthcare, for which his institution has received remuneration. C. S. has received funding for the membership of data safety and monitoring boards, advisory boards, speakers' panels, and for the preparation of educational materials from Gilead Sciences, ViiV Healthcare, and Janssen-Cilag. A. So. has served as a board member for Gilead Sciences and GSK/ViiV Healthcare; has received speaker's fees from BMS Scandinavia, Gilead Sciences, Janssen-Cilag, and GlaxoSmithKline/ViiV Healthcare; and has received payment for educational activities from GSK/ViiV Healthcare and meeting expenses from Gilead Sciences. G. T. has received grant support from Gilead Sciences Europe, University of Minnesota, ECDC, and EU and national funds, paid to her institution. A. v. S. received grants from the ECDC, consulting fees from ViiV Healthcare, and payment for lectures from Gilead Sciences and Janssen-Cilag, all paid to his institution. All other authors have no conflicts of interest to declare. The authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

References

- Centers for Disease Control and Prevention. Vital signs: HIV prevention through care and treatment—United States. *MMWR Morb Mortal Wkly Rep* **2011**; 60:1618–23.
- Joint United Nations Programme on HIV/AIDS. 90-90-90 an ambitious target to help end the AIDS epidemic. Geneva, Switzerland: UNAIDS, **2014**.
- European Centre for Disease Prevention and Control. Thematic report: HIV continuum of care. Monitoring implementation of the Dublin Declaration on Partnership to Fight HIV/AIDS in Europe and Central Asia: 2014 progress report. Stockholm, Sweden: ECDC, **2015**.
- Drew RS, Rice B, Ruutel K, et al. HIV continuum of care in Europe and Central Asia [Epub ahead of print]. *HIV Med* **2017**. doi:10.1111/hiv.12480.
- Medland NA, McMahon JH, Chow EP, Elliott JH, Hoy JE, Fairley CK. The HIV care cascade: a systematic review of data sources, methodology and comparability. *J Int AIDS Soc* **2015**; 18:20634.
- Haber N, Pillay D, Porter K, Bärnighausen T. Constructing the cascade of HIV care: methods for measurement. *Curr Opin HIV AIDS* **2016**; 11:102–8.
- EuroCoord. Enhancing clinical and epidemiological HIV research in Europe through cohort collaboration. Available at: <http://www.eurocoord.net/>. Accessed 15 August 2016.
- de Wolf F, Sabin C, Kirk O, Thorne C, Chene G, Porter K; for EuroCoord. Developing a multidisciplinary network for clinical research on HIV infection: the EuroCoord experience. *Clin Invest* **2012**; 2:255–64.
- European Centre for Disease Prevention and Control. ECDC HIV Modelling Tool [software application]. Available at: <http://ecdc.europa.eu/en/healthtopics/aids/Pages/hiv-modelling-tool.aspx>. Version 1.0.1 Stockholm ed. Stockholm: ECDC, **2015**.
- van Sighem A, Nakagawa F, De Angelis D, et al. Estimating HIV incidence, time to diagnosis, and the undiagnosed HIV epidemic using routine surveillance data. *Epidemiology* **2015**; 26:653–60.
- An der Heiden M, Marcus U, Günsheimer-Bartmeyer B, Bremer V. Undiagnosed HIV infection in Germany: who do we need to target? 21st International AIDS Conference, Durban, South Africa, **2016**. Abstract number TUPEC137.
- Mammone A, Pezzotti P, Regine V, et al. How many people are living with undiagnosed HIV infection? An estimate for Italy, based on surveillance data. *AIDS* **2016**; 30:1131–6.
- Supervie V, Ndawin JD, Lodi S, Costagliola D. The undiagnosed HIV epidemic in France and its implications for HIV screening strategies. *AIDS* **2014**; 28:1797–804.
- Goubar A, Ades AE, De Angelis D, et al. Estimates of human immunodeficiency virus prevalence and proportion diagnosed based on Bayesian multiparameter synthesis of surveillance data. *J R Stat Soc* **2008**; 171:541–80.
- European Commission. Eurostat: your key to European statistics. Available at: <http://ec.europa.eu/eurostat>. Accessed 6 December 2016.
- Supervie V, Marty L, Lacombe JM, Dray-Spira R, Costagliola D; FHDH-ANRS CO4 Study Group. Looking beyond the cascade of HIV care to end the AIDS epidemic: estimation of the time interval from HIV infection to viral suppression. *J Acquir Immune Defic Syndr* **2016**; 73:348–55.
- Camoni L, Raimondo M, Dorrucchi M, Regine V, Salfa MC, Suligoi B; CARPHA Study Group. Estimating minimum adult HIV prevalence: a cross-sectional study to assess the characteristics of people living with HIV in Italy. *AIDS Res Hum Retroviruses* **2015**; 31:282–7.
- European Centre for Disease Prevention and Control and World Health Organization Regional Office for Europe. HIV/AIDS surveillance in Europe 2014. Stockholm, Sweden: ECDC, **2015**.
- World Health Organization. Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection 2016: recommendations for a public health approach. 2nd ed. Geneva, Switzerland: WHO, **2016**.
- van Sighem AI, Gras L, Smit C, Stolte I, Reiss P. Monitoring report 2015. Human immunodeficiency virus (HIV) infection in the Netherlands. Amsterdam: Stichting HIV Monitoring, November 2015.
- Skingsley A, Yin Z, Kirwan P, et al. HIV in the UK—situation report 2015: data to end 2014. London: Public Health England, **2015**.
- van Sighem A, Engelhard E, Op de Coul E, et al. A new method to estimate the first step in the HIV care continuum. In: 15th European AIDS Conference, Barcelona, Spain, **2015**.
- Gisslen M, Svedhem V, Lindborg L, et al. Sweden, the first country to achieve the Joint United Nations Programme on HIV/AIDS (UNAIDS)/World Health Organization (WHO) 90-90-90 continuum of HIV care targets. *HIV Med* **2017**; 18: 305–7.
- Sasse A, Deblonde J, Jamine D, Ost C, Van Beckhoven D. *Epidémiologie du SIDA et de l'infection à VIH en Belgique: Situation au 31 décembre 2015*. Brussels, Belgium: Scientific Institute of Public Health, **2016**.
- Van Beckhoven D, Florence E, Ruelle J, et al; BREACH Belgian Research on AIDS and HIV Consortium. Good continuum of HIV care in Belgium despite weaknesses in retention and linkage to care among migrants. *BMC Infect Dis* **2015**; 15:496.
- Joint United Nations Programme on HIV/AIDS. Methods for deriving UNAIDS estimates. Geneva, Switzerland: UNAIDS, **2016**.
- Joint United Nations Programme on HIV/AIDS. The GAP report. Geneva, Switzerland: UNAIDS, **2014**.
- Mocroft A, Lundgren JD, Sabin ML, et al; Collaboration of Observational HIV Epidemiological Research Europe (COHERE) Study in EuroCoord. Risk factors and outcomes for late presentation for HIV-positive persons in Europe: results from the Collaboration of Observational HIV Epidemiological Research Europe Study (COHERE). *PLoS Med* **2013**; 10:e1001510.
- Lorenc T, Marrero-Guillamón I, Aggleton P, et al. Promoting the uptake of HIV testing among men who have sex with men: systematic review of effectiveness and cost-effectiveness. *Sex Transm Infect* **2011**; 87:272–8.
- Fernández-Balbuena S, Marcos H, Pérez-Rubio A, Hoyos J, Belza MJ, de la Fuente L. The rapid test in Spanish pharmacies: a novel programme to reach heterosexual men? *HIV Med* **2015**; 16:362–9.
- Joore IK, Arts DL, Kruijer MJ, et al. HIV indicator condition-guided testing to reduce the number of undiagnosed patients and prevent late presentation in a high-prevalence area: a case-control study in primary care. *Sex Transm Infect* **2015**; 91:467–72.
- Sullivan AK, Raben D, Reekie J, et al. Feasibility and effectiveness of indicator condition-guided testing for HIV: results from HIDES I (HIV indicator diseases across Europe study). *PLoS One* **2013**; 8:e52845.
- Hall HI, Halverson J, Wilson DP, et al. Late diagnosis and entry to care after diagnosis of human immunodeficiency virus infection: a country comparison. *PLoS One* **2013**; 8:e77763.
- International Advisory Panel on HIV Care Continuum Optimization. IAPAC guidelines for optimizing the HIV care continuum for adults and adolescents. *J Int Assoc Provid AIDS Care* **2015**; 14:S3–4.
- Vourli G, Pharris A, Cazein F, et al. Assessing the representativeness of European HIV cohort participants as compared to HIV surveillance data. In: HepHIV 2017 Conference, Malta, 31 January–2 February **2017**. Abstract PS3/01.
- British HIV Association. British HIV Association clinical audit report 2012–13. London: BHA, **2013**.
- Crepaz N, Tang T, Marks G, Mugavero MJ, Espinoza L, Hall HI. Durable viral suppression and transmission risk potential among persons with diagnosed HIV infection: United States, 2012–2013. *Clin Infect Dis* **2016**; 63: 976–83.

APPENDIX

Austrian HIV Cohort Study, Austria:

Steering committee members: Ninon Taylor, Maria Geit, Bernhard Haas, Manfred Kanatschnig, Armin Rieger, Andrea Steuer, Robert Zangerle

Coordinating Centre: University Hospital Innsbruck (Robert Zangerle)

Funding: Austrian Agency for Health and Food Safety (AGES), Hospitals running HIV treatment centres, pharmaceutical companies (equal contributions, irrespective of their market shares)

HIV treatment centres (*site coordinating physicians): LKH Innsbruck: Martin Gisinger, Maria Kitchen, Alexander Plattner, Elisabeth Rieser, Mario Sarcletti*, Robert Zangerle. LKH Salzburg: Alexander Egle, Richard Greil*, Michaela Schachner, Ninon Taylor. Kepler Universitätsklinikum Med Campus III. Linz: Maria Geit*, Angela Öllinger. AKH Vienna: Regina Aichwalder, Katharina Grabmeier-Pfistershammer, Armin Rieger*, Veronique Touzeau. Otto-Wagner Hospital Vienna: Piotr Cichon, Manfred Gartner, Brigitte Schmied, Andrea Steuer*. Kaiser-Franz-Josef Hospital Vienna: Hermann Laferl, Alexander Zoufaly*. LKH Graz Süd-West: Bernhard Haas*, Andreas Kapper, Elmar Wallner. LKH Klagenfurt: Manfred Kanatschnig*, Georg Schober.

Virology: Elisabeth Puchhammer-Stöckl (Vienna), Jörg Berg (Kepler Universitäts-klinikum Med Campus III, Linz).

Data management: Heinz Appoyer (IT-related), Gisela Leierer (AHIVCOS), Michaela Rappold (AHIVCOS), Stefanie Strickner (AHIVCOS).

Data safety and protection: Klaus Schindelig (Innsbruck).

Scientific advisory board: Bruno Ledergerber (Zurich), Gerd Fätkenheuer (Cologne).

Belgian HIV cohort, Belgium:

The Belgian HIV surveillance including the Belgian HIV cohort is coordinated by the WIV/ISP (Scientific Institute of Public Health) and financed by the Belgian National Institute for Sickness and Invalidity Insurance (INAMI/RIZIV).

The WIV-ISP thanks the following members of the Belgian Research on AIDS and HIV Consortium (BREACH) for providing the data: S. De Wit (ARC CHU Saint-Pierre), M.-L. Delforge (ARL Hôpital Erasme), E. Florence (ARC ITG), K. Fransen (ARL ITG), J.-C. Goffard (ARC Hôpital Erasme), M.-P. Hayette (ARL CHU Liège), P. Lacor (ARC UZ Brussel), R. Demeester (ARC CHU Charleroi), M. Moutschen (ARC CHU Liège), D. Piérard (ARL UZ Brussel), J. Ruelle (ARL UCL), D. Vaira (ARL CHU Liège), L. Vandekerckhove (ARC UZ Gent), S. Van den Wijngaert (ARL Hôpital Saint-Pierre), B. Vandercam (ARC Cliniques Universitaires Saint-Luc), M. Van Ranst (ARL KUL), E. Van Wijngaerden (ARC UZ Leuven), C. Verhofstede (ARL UZ Gent).

Danish HIV Cohort Study, Denmark:

This work was supported by Preben og Anne Simonsens Foundation.

The Danish HIV Cohort Study includes patients from the Departments of Infectious Diseases at Copenhagen University Hospitals, Rigshospitalet (J. Gerstoft, N. Obel) and Hvidovre (G. Kronborg), Odense University Hospital (C. Pedersen), Aarhus University Hospitals, Skejby (C.S. Larsen) and Aalborg (G. Pedersen), Herning Hospital (R. Mohey), Hillerød Hospital (L. Nielsen), Roskilde Hospital (L. Weise), Herlev University Hospital (B. Kvinesdal) and Kolding Hospital (J. Jensen).

FHDH-ANRS CO4 cohort, France:

The FHDH ANRS CO4 cohort is funded by the ANRS, INSERM and the French Ministry of Health.

- Scientific committee: S. Abgrall, L. Bernard, E. Billaud, F. Boué, L. Boyer, A. Cabié, F. Caby, A. Canestri, D. Costagliola, L. Cotte, P. De Truchis, X. Duval, C. Duvivier, P. Enel, H. Fischer, J. Gasnault, C. Gaud, S. Grabar, MA Khuong, O. Launay, L. Marchand, M. Mary-Krause, S. Matheron, G. Melica-Grégoire, H. Melliez, JL Meynard, M. Nacher, J. Pavie, L. Piroth, I. Poizot-Martin, C. Pradier, J. Reynes, E. Rouveix, A. Simon, L. Slama, P. Tattevin, H. Tissot-Dupont.
- COREVIH coordinating center: French Ministry of Health (G. Astier, J. Biga, T. Kurth, I. Prade), Technical Hospitalization Information Agency, ATIH (N. Jacquemet).

- Statistical analysis center: UMRS 1136 INSERM et UPMC (D. Costagliola, *Principal investigator*, S. Abgrall, S. Grabar, M. Guiguet, S. Lang, L. Lièvre, M. Mary-Krause, H. Roul, H. Selinger-Leneman), INSERM-Transfert (V. Potard).
- COREVIH: Paris area: Corevih Ile de France Centre (Paris-GH Pitié Salpêtrière: O. Benveniste, A. Simon, G. Breton, C. Lupin, E. Bourzaim; Paris-Hôpital Saint-Antoine: PM Girard, L. Fonquernie, N. Valin, B. Lefebvre, M. Sebire; Paris-Hôpital Tenon: G. Pialoux, MG Lebrette, P. Thibaut, A. Adda, M. Hamidi, J. Cadranel, A. Lavolé, A. Parrot), Corevih Ile de France Est (Bobigny-Hôpital Avicenne: O. Bouchaud, N. Vignier, F. Méchai, S. Makhoulfi, P. Honoré; Bondy-Hôpital Jean Verdier; Paris-GH Lariboisière-Fernand Widal: JF Bergmann, V. Delcey, A. Lopes, P. Sellier, M. Parrinello Paris-Hôpital Saint-Louis: E. Oksenhendler, L. Gerard, JM Molina, W. Rozenbaum, B. Denis, N. De Castro, C. Lascoux), Corevih Ile de France Nord (Paris-Hôpital Bichat-Claude Bernard: Y. Yazdanpanah, S. Matheron, S. Lariven, V. Joly, C. Rioux; St Denis-Hôpital Delafontaine: MA Khuong-Josses, M. Poupard, B. Taverne), Corevih Ile de France Ouest (Argenteuil-CH Victor Dupouy: L. Sutton, V. Masse, P. Genet, B. Wifaq, J. Gerbe; Boulogne Billancourt-Hôpital Ambroise Paré: E. Rouveix, S. Greffe, C. Dupont, A. Freire Maresca, E. Reimann; Colombes-Hôpital Louis Mourier: M. Bloch, F. Meier, E. Mortier, F. Zeng, B. Montoya; Garches-Hôpital Raymond Poincaré: C. Perronne P. de Truchis, D. Mathez, D. Marigot-Outtandy, H. Berthé; Le Chesnay-Hôpital André Mignot: A. Greder Belan, A. Therby, C. Godin Collet, S. Marque Juillet, M. Ruquet, S. Roussin-Bretagne, P. Colardelle; Mantes La Jolie-CH François Quesnay: F. Granier, JJ Laurichesse, V. Perronne; Meulan-CHI de Meulan les Mureaux: T. Akpan, M. Marcou; Nanterre-Hôpital Max Fourestier: V. Daneluzzi, J. Gerbe; Poissy-CHI de Poissy: C. Veyssier-Belot, H. Masson; St Germaine en Laye-CHI de St-Germain-en-Laye: Y. Welker, P. Brazille; Suresnes-Hôpital Foch: JE Kahn, D. Zucman, C. Majerholc, E. Fourn, D. Bornarel), Corevih Ile de France Sud (Clamart-Hôpital Antoine Bécère: F. Boué, S. Abgrall, V. Chambrin, I. Kansau, M. Raho-Moussa; Créteil-Hôpital Henri Mondor: JD Lelievre, G. Melica, M. Saidani, C. Chesnel, C. Dumont; Kremlin Bicêtre-Hôpital de Bicêtre: D. Vittecoq, O. Derradji, C. Bolliot, C. Goujard, E. Teicher, J. Gasnault, M. Mole, K. Bourdic; Paris-GH Tarnier-Cochin: D. Salmon, C. Le Jeune, O. Launay, P. Guet, MP Pietri, E. Pannier Metzger, V. Marcou, P. Loulergue, N. Dupin, JP Morini, J. Deleuze, P. Gerhardt, J. Chanal; Paris-Hôpital Européen Georges Pompidou: L. Weiss, J. Pavie, M. Lucas, C. Jung, M. Ptak; Paris-Hôpital Hôtel Dieu: JP Viard, J. Ghosn, P. Gazalet, A. Cros, A. Maignan; Paris-Hôpital Necker adultes: C. Duvivier, O. Lortholary, C. Rouzaud, F. Touam, K. Benhadj; Paris-CMIP Pasteur: PH Consigny, P. Bossi, A. Gergely, G. Cessot, F. Durand).

Outside Paris area: Corevih Alsace (CH de Mulhouse: G Beck-Wirth, C Michel, M Benomar; CHRU de Strasbourg: D Rey, M Partisani, C Cheneau, ML Batard, P Fischer), Corevih de l'Arc Alpin (CHU de Grenoble: P Leclercq, M Blanc, P Morand, O Epaulard, A Signori-Schmuck), Corevih Auvergne-Loire (CHU de Clermont-Ferrand: H Laurichesse, C Jacomet, M Vidal, D Coban, S Casanova; CHRU de Saint-Etienne: A Fresard, C Guglielminotti, E Botelho-Nevers, A Brunon-Gagneux, V Ronat); Corevih Basse-Normandie (CHRU de Caen: R Verdon, S Dargère, E Haustraete, P Féret, P Goubin), Corevih Bourgogne (CHRU de Dijon: P Chavanet, A Fillion, L Piroth, D Croisier, S Gohier), Corevih Bretagne (CHU de Rennes: C Arvieux, F Souala, JM Chaplain, M Ratajczak, J Rohan), Corevih Centre Poitou-Charentes (CHRU de Tours), Corevih Franche-Comté (CH de Belfort: JP Faller, O Ruyer, V Gendrin, L Toko; CHRU de Besançon: C Chirouze, L Hustache-Mathieu, JF Faucher, A Proust, N Magy-Bertrand, H Gil, N Méaux-Ruault); Corevih Haute-Normandie (CHRU de Rouen), Corevih Languedoc-Roussillon (CHU de Montpellier; CHU de Nîmes: A Sotto, I Rouanet, JM Mauboussin, R Doncesco, G Jacques), Corevih Lorraine Champagne Ardennes (Nancy-Hôpital de Brabois: T May, C Rabaud, M Andre, M Delestan, MP Bouillon; CHRU de Reims: F Bani-Sadr, C Rouger, JL Berger, Y Nguyen), Corevih de Midi-Pyrénées Limousin (Toulouse CHU Purpan: B Marchou, P Delobel, G Martin Blondel, L Cuzin, N Biezunski, L Alric, D Bonnet, M Guivarch, A Palacin, V Payssan), Corevih Nord-Pas de Calais (CH de Tourcoing: H Melliez, F Ajana, A Meybeck, N Viget), Corevih PACA Est (Nice Hôpital Archet 1: C Pradier, P Pugliese, PM Roger, E Rosenthal, J Durant, E Cua, A Naqvi, I Perbost, K Risso; CH Antibes-Juan les Pins: D Quinsat; CHI de Fréjus/St Raphaël: P Del Giudice; CH de Grasse: PY Dides), Corevih PACA Ouest (Marseille-Hôpital de la Conception: P Enel, R Sambuc, MS Antolini-Bouvenot, P Druart, L Meddeb, I Ravaux, A Menard, C Tomei, C Dhiver, H Tissot-Dupont; Marseille-Hôpital Nord: J Moreau, S Mokhtari, MJ Soavi, V Thomas; Marseille-Hôpital Sainte-Marguerite: I Poizot-Martin, S Bregigeon, O Faucher, V Obry-Roguet, AS Ritleng, N Petit; Marseille-Centre pénitentiaire des Baumettes: C Bartoli, JM Ruiz, D Blanc; CH d'Aix-En-Provence: T Allegre, M Sordage, JM Riou, C Faudon; CH d'Avignon: B Slama, H Zerazhi, O Boulat, S Chebrek, M Beyrne; CH de Digne Les Bains: P Granet Brunello; CH de Gap: L Pellissier, D Bonnabel; CH de Martigues: R Cohen Valensi, B Mouchet, G Mboungou; CHI de Toulon: A Lafeuillade, E Hope-Rapp, G Hittinger, G Philip, V Lambry), Corevih Pays de la Loire (CHU de Nantes: F Raffi, C Allavena, E Billaud, N Hall, V Reliquet), Corevih de la Vallée du Rhône (Lyon-Hôpital de la Croix-Rousse: C Chidiac, L Cotte, T Ferry, T Perpoint, P Miaillhes; Lyon-Hôpital Edouard Herriot: A Boibieux, JM Livrozet, D Makhloufi, F Brunel, P Chiarello).

Overseas: Corevih Guadeloupe (CHU de Pointe-à-Pitre: B Hoen, I Lamaury, I Fabre, K Samar, E Duvalon; CH Saint-Martin: C Clavel, S Stegmann, V Walter), Corevih Guyane (CH

de Cayenne: M Nacher, L Adriouch, F Huber, V Vantickel, P Couppié), Corevih Martinique (CHU de Fort-de-France: A Cabié, S Abel, S Pierre-François), Corevih de La Réunion (St Denis-CHU Félix Guyon: C Gaud, C Ricaud, R Rodet, G Wartel, C Sautron; St Pierre-GH Sud Réunion: P Poubeau, G Borgherini, G Camuset).

ClinSurv HIV, Germany:

The clinical surveillance of HIV, ClinSurv HIV, is funded by the Robert Koch Institute, which is the German Public Health Institute.

Berlin: PD Dr K. Arastéh, S. Kowohl Vivantes (Auguste-Viktoria-Clinic); Dr D. Schürmann, M. Warncke Charité, University Medicine Berlin; Bonn: Prof. Dr J. Rockstroh, Dr J. Wasmuth, S. Hass University Medical Centre Bonn; Duesseldorf: PD Dr. B.O. Jensen, C. Feind University Medical Centre Düsseldorf; Essen: Dr S. Esser, P. Schenk-Westkamp University Clinic Essen; Frankfurt: A. Haberl, C. Stephan HIV Center J.W.Goethe-University Frankfurt; Hamburg: Prof. Dr A. Plettenberg, F. Kuhlendahl ifi (Institute for Interdisciplinary Medicine); Drs. A. Adam/ L. Weitner/ K. Schewe, H. Goey, Drs. S. Fenske/ T. Buhk/ Prof. HJ. Stellbrink/ PD C. Hoffmann/ S Hansen at ICH (Infectious Diseases Centre) Study Centre Hamburg Hamburg; PD Dr. O Degen, M. Heuer at University Medical Centre Hamburg-Eppendorf; Hannover: Prof. Dr M. Stoll, S. Gerschmann at Medical University Hannover; Kiel: Prof. Dr H. Horst, S. Trautmann at University Clinic Schleswig-Holstein; Cologne: Prof Dr G. Fätkenheuer, D. Gillor at University Medical Centre Cologne; Munich: Prof Dr J. Bogner, B. Sonntag at University Hospital Munich; Regensburg: Prof Dr B. Salzberger at University Medical Centre Regensburg; Rostock: Dr C. Fritzsche at University Clinic Rostock.

AMACS, Greece:

The AMACS is a collaborative, open, ongoing, population-based cohort study started in 1996, initially supported financially by the Hellenic Center for Infectious Diseases Control (HCIDC).

Steering Committee: Antoniadou A., Chrysos G., Daikos G., Gargalianos-Kakolyris P., Gogos HA., Katsarou O., Lazanas M., Metallidis S., Panagopoulos P., Panos G., Paparizos V., Paraskevis D., Sambatakou H., Sipsas N., Skoutelis A., Touloumi G. (Chair).

Coordinating Center: Department of Hygiene, Epidemiology and Medical Statistics, Athens University Medical School, Greece (Touloumi G., Pantazis N., Vourli G., Souliou T., Gioukari V.)

Participating Centers: 4th Dept of Internal Medicine, Athens Medical School, Attikon University Hospital (Antoniadou A, Papadopoulos A, Petrikos G); Infectious Disease Unit, "Tzaneio" General Hospital of Pireaus (Chrysos G, Paraskeva D, Hatziastras P); 1st Dept of Propedeutic Medicine, Athens University, Medical School "Laikon" General Hospital (Daikos G, Psychogiou M); 1st Dept of Medicine, Infectious Diseases

Unit, "G. Gennimatas" Athens General Hospital (Gargalianos-Kakolyris P, Xylomenos G); 1st Dept of Internal Medicine, Infectious Diseases Section, Patras University Hospital (Gogos HA, Marangos MN, Panos G); Haemophilia Centre, 2nd Blood Transfusion Centre, "Laikon" Athens General Hospital (Katsarou O, Kouramba A, Ioannidou P); AIDS Unit, Dept of Pathophysiology, "Laikon" Athens General Hospital and Athens University, Medical School (Sipsas NV, Kontos A); Infectious Diseases Unit, Red Cross General Hospital of Athens (Lazanas M, Chini M, Tsogas N); 1st Dept of Internal Medicine, Infectious Diseases Division, AHEPA University Hospital, Aristotle University HIV Unit (Metallidis S, Tsachouridou O, Skoura L); 2nd Internal Medicine Clinic, 1st IKA (Panos G, Haratsis G); AIDS Unit, Clinic of Venereologic & Dermatologic Diseases, Athens University, Medical School, Syngros Hospital (Paparizos V, Leuow K, Kourkounti S); HIV Unit, 2nd Dpt. of Internal Medicine, Athens University, Medical School, Hippokraton General Hospital (Sambatakou H, Mariolis I); Infectious Diseases & HIV Division, Dept of Internal Medicine, Evaggelismos Athens General Hospital (Skoutelis A, Papastamopoulos V); Infectious Diseases Unit, University General Hospital of Alexandroupolis, Democritus University of Thrace (Panagopoulos P, Ganitis A).

ICoNA, Italy:

Board of Directors: A d'Arminio Monforte (President), M Andreoni, A Antinori, A Castagna, F Castelli, R Cauda, G Di Perri, M Galli, R Iardino, G Ippolito, A Lazzarin, G Marchetti, CF Perno, F von Schloesser, P Viale.

Scientific Secretary: A d'Arminio Monforte, A Antinori, A Castagna, F Ceccherini-Silberstein, A Cozzi-Lepri, E Girardi, S Lo Caputo, C Mussini, M Puoti.

Steering Committee: M Andreoni, A Ammassari, A Antinori, C Balotta, A Bandera, P Bonfanti, S Bonora, M Borderi, A Calcagno, L Calza, MR Capobianchi, A Castagna, F Ceccherini-Silberstein, A Cingolani, P Cinque, A Cozzi-Lepri, A d'Arminio Monforte, A De Luca, A Di Biagio, E Girardi, N Gianotti, A Gori, G Guaraldi, G Lapadula, M Lichtner, S Lo Caputo, G Madeddu, F Maggiolo, G Marchetti, S Marcotullio, L Monno, C Mussini, S Nozza, M Puoti, E Quiros Roldan, R Rossotti, S Rusconi, MM Santoro, A Saracino, M Zaccarelli.

Statistical And Monitoring Team: A Cozzi-Lepri, I Fanti, L Galli, P Lorenzini, A Rodano, M Shanyinde, A Tavelli.

Biological Bank INMI: F Carletti, S Carrara, A Di Caro, S Graziano, F Petrone, G Prota, S Quartu, S Truffa.

Participating Physicians And Centers: A Giacometti, A Costantini, C Valeriani (Ancona); G Angarano, L Monno, C Santoro (Bari); F Maggiolo, C Suardi (Bergamo); P Viale, V Donati, G Verucchi (Bologna); F Castelli, E Quiros Roldan, C Minardi (Brescia); T Quirino, C Abeli (Busto Arsizio); PE Manconi, P Piano (Cagliari); B Cacopardo, B Celesia (Catania); J Vecchiet, K Falasca (Chieti); L Sighinolfi, D Segala (Ferrara); F

Mazzotta, F Vichi (Firenze); G Cassola, C Viscoli, A Alessandrini, N Bobbio, G Mazzarello (Genova); C Mastroianni, V Belvisi (Latina); P Bonfanti, I Caramma (Lecco); A Chiodera, AP Castelli (Macerata); M Galli, A Lazzarin, G Rizzardini, M Puoti, A d'Arminio Monforte, AL Ridolfo, R Piolini, A Castagna, S Salpietro, L Carenzi, MC Moioli, C Tincati, G Marchetti (Milano); C Mussini, C Puzzolante (Modena); A Gori, G Lapadula (Monza); N Abrescia, A Chirianni, G Borgia, F Di Martino, L Maddaloni, I Gentile, R Orlando (Napoli); F Baldelli, D Francisci (Perugia); G Parruti, T Ursini (Pescara); G Magnani, MA Ursitti (Reggio Emilia); R Cauda, M Andreoni, A Antinori, V Vullo, A Cristaudo, A Cingolani, G Baldin, S Cicalini, L Gallo, E Nicastrì, R Acinapura, M Capozzi, R Libertone, S Savinelli, A Latini, G Iaiani, L Fontanelli Sulekova (Roma); M Cecchetto, F Viviani (Rovigo); MS Mura, G Madeddu (Sassari); A De Luca, B Rossetti (Siena); P Caramello, G Di Perri, GC Orofino, S Bonora, M Sciandra (Torino); M Bassetti, A Londero (Udine); G Pellizzer, V Manfrin (Vicenza).

ATHENA, The Netherlands:

The ATHENA database is maintained by Stichting HIV Monitoring and supported by a grant from the Dutch Ministry of Health, Welfare and Sport through the Centre for Infectious Disease Control of the National Institute for Public Health and the Environment.

Clinical Centres (*denotes site coordinating physician):

Academic Medical Centre of the University of Amsterdam: HIV treating physicians: J.M. Prins*, T.W. Kuijpers, H.J. Scherpbier, J.T.M. van der Meer, F.W.M.N. Wit, M.H. Godfried, P. Reiss, T. van der Poll, F.J.B. Nellen, S.E. Geerlings, M. van Vugt, D. Pajkrt, W.J. Wiersinga, M. van der Valk, A. Goorhuis, J.W. Hovius. HIV nurse consultants: M.A.H. Bijsterveld, J. van Eden, A.M.H. van Hes, M. Mutschelknauss, H.E. Nobel, F.J.J. Pijnappel, A.M. Weijnsfeld. HIV clinical virologists/chemists: S. Jurriaans, N.K.T. Back, H.L. Zaaijer, B. Berkhout, M.T.E. Cornelissen, C.J. Schinkel, X.V. Thomas. Admiraal De Ruyter Ziekenhuis, Goes: HIV treating physicians: M. van den Berge, A. Stegeman. HIV nurse consultants: S. Baas, L. Hage de Looff. HIV clinical virologists/chemists: B. Wintermans, J. Veenemans. Catharina Ziekenhuis, Eindhoven: HIV treating physicians: M.J.H. Pronk*, H.S.M. Ammerlaan. HIV nurse consultants: E.S. de Munnik, E. van Beek. HIV clinical virologists/chemists: A.R. Jansz, J. Tjhie, M.C.A. Wegdam, B. Deiman, V. Scharnhorst. Elisabeth-TweeSteden Ziekenhuis, Tilburg: HIV treating physicians: M.E.E. van Kasteren*, A.E. Brouwer. HIV nurse consultants: R. van Erve, B.A.F.M. de Kruijf-van de Wiel, S.Keelan-Pfaf, B. van der Ven. Data collection: B.A.F.M. de Kruijf-van de Wiel, B. van der Ven. HIV clinical virologists/chemists: A.G.M. Buiting, P.J. Kabel, D.Versteeg. Emma Kinderziekenhuis: HIV nurse consultants: A. van der Plas, A.M. Weijnsfeld. Erasmus MC, Rotterdam: HIV treating physicians: M.E. van der Ende*, H.I. Bax, E.C.M. van Gorp,

J.L. Nouwen, B.J.A. Rijnders, C.A.M. Schurink, A. Verbon, T.E.M.S. de Vries-Sluijs. HIV nurse consultants: N. Bassant, J.E.A. van Beek, M. Vriesde, L.M. van Zonneveld. Data collection: H.J. van den Berg-Cameron, F.B. Bruinsma-Broekman, J. de Groot, M. de Zeeuw-de Man. HIV clinical virologists/chemists: C.A.B. Boucher, M.P.G. Koopmans, J.J.A. van Kampen, S.D. Pas. Erasmus MC–Sophia, Rotterdam: HIV treating physicians: G.J.A. Driessen, A.M.C. van Rossum. HIV nurse consultants: L.C. van der Knaap, E. Visser. Flevoziekenhuis, Almere: HIV treating physicians: J. Branger*, A. Rijkeboer-Mes. HIV nurse consultant and data collection: C.J.H.M. Duijf-van de Ven. HagaZiekenhuis, Den Haag: HIV treating physicians: E.F. Schippers*, C. van Nieuwkoop. HIV nurse consultants: J.M. van Ijperen, J. Geilings. Data collection: G. van der Hut. HIV clinical virologist/chemist: P.F.H. Franck. HIV Focus Centrum (DC Klinieken): HIV treating physicians: A. van Eeden*. HIV nurse consultants: W. Brokking, M. Groot, L.J.M. Elsenburg. HIV clinical virologists/chemists: M. Damen, I.S. Kwa. Isala, Zwolle: HIV treating physicians: P.H.P. Groeneveld*, J.W. Bouwhuis. HIV nurse consultants: J.F. van den Berg, A.G.W. van Hulzen. Data collection: G.L. van der Blik, P.C.J. Bor. HIV clinical virologists/chemists: P. Bloembergen, M.J.H.M. Wolfhagen, G.J.H.M. Ruijs. Leids Universitair Medisch Centrum, Leiden: HIV treating physicians: F.P. Kroon*, M.G.J. de Boer, H. Jolink, A.M. Vollaard. HIV nurse consultants: W. Dorama, N. van Holten. HIV clinical virologists/chemists: E.C.J. Claas, E. Wessels. Maasstad Ziekenhuis, Rotterdam: HIV treating physicians: J.G. den Hollander*, K. Pogany, A. Roukens. HIV nurse consultants: M. Kastelijns, J.V. Smit, E. Smit, D. Struik-Kalkman, C. Tearno. Data collection: M. Bezemer, T. van Niekerk. HIV clinical virologists/chemists: O. Pontesilli. Maastricht UMC+, Maastricht: HIV treating physicians: S.H. Lowe*, A.M.L. Oude Lashof, D. Posthouwer. HIV nurse consultants: R.P. Ackens, J. Schippers, R. Vergoossen. Data collection: B. Weijenberg-Maes. HIV clinical virologists/chemists: I.H.M. van Loo, T.R.A. Havenith. MCH-Bronovo, Den Haag: HIV treating physicians: E.M.S. Leyten*, L.B.S. Gelinck. HIV nurse consultants: A.Y. van Hartingsveld, C. Meerkerk, G.S. Wildenbeest. HIV clinical virologists/chemists: J.A.E.M. Mutsaers, S.Q. van Veen. MC Slotervaart, Amsterdam: HIV treating physicians: J.W. Mulder*, S.M.E. Vrouwenraets, F.N. Lauw. HIV nurse consultants: M.C. van Broekhuizen, H. Paap, D.J. Vlasblom. HIV clinical virologists/chemists: P.H.M. Smits. MC Zuiderzee, Lelystad: HIV treating physicians: S. Weijer*, R. El Moussaoui. HIV nurse consultant: A.S. Bosma. Medisch Centrum Leeuwarden, Leeuwarden: HIV treating physicians: M.G.A. van Vonderen*, D.P.F. van Houte, L.M. Kampschreur. HIV nurse consultants: K. Dijkstra, S. Faber. HIV clinical virologists/chemists: J. Weel. Medisch Spectrum Twente, Enschede: HIV treating physicians: G.J. Kootstra*, C.E. Delsing. HIV nurse consultants: M. van der Burg-van de Plas, H. Heins. Data collection: E. Lucas. Noordwest Ziekenhuisgroep, Alkmaar:

HIV treating physicians: W. Kortmann*, G. van Twillert*, J.W.T. Cohen Stuart, B.M.W. Diederens, R. Renckens. HIV nurse consultant and data collection: D. Ruiter-Pronk, F.A. van Truijen-Oud. HIV clinical virologists/chemists: W. A. van der Reijden, R. Jansen. OLVG, Amsterdam: HIV treating physicians: K. Brinkman*, G.E.L. van den Berk, W.L. Blok, P.H.J. Frissen, K.D. Lettinga W.E.M. Schouten, J. Veenstra. HIV nurse consultants: C.J. Brouwer, G.F. Geerders, K. Hoeksema, M.J. Kleene, I.B. van der Meché, M. Spelbrink, H. Sulman, A.J.M. Toonen, S. Wijnands. HIV clinical virologists: M. Damen, D. Kwa. Data collection: E. Witte. Radboudumc, Nijmegen: HIV treating physicians: R. van Crevel*, M. Keuter, A.J.A.M. van der Ven, H.J.M. ter Hofstede, A.S.M. Dofferhoff. HIV nurse consultants: M. Albers, K.J.T. Grintjes-Huisman, M. Marneef, A. Hairwassers. HIV clinical virologists/chemists: J. Rahamat-Langendoen. HIV clinical pharmacology consultant: D. Burger. Rijnstate, Arnhem: HIV treating physicians: E.H. Gisolf*, R.J. Hassing, M. Claassen. HIV nurse consultants: G. ter Beest, P.H.M. van Bentum, N. Langebeek. HIV clinical virologists/chemists: R. Tiemessen, C.M.A. Swanink. Spaarne Gasthuis, Haarlem: HIV treating physicians: S.F.L. van Lelyveld*, R. Soetekouw. HIV nurse consultants: L.M.M. van der Pijlt, J. van der Swaluw. Data collection: N. Bermon. HIV clinical virologists/chemists: W.A. van der Reijden, R. Jansen, B.L. Herpers, D. Veenendaal. Medisch Centrum Jan van Goyen, Amsterdam: HIV treating physicians: D.W.M. Verhagen. HIV nurse consultants: M. van Wijk. Universitair Medisch Centrum Groningen, Groningen: HIV treating physicians: W.F.W. Bierman*, M. Bakker, J. Kleinnijenhuis, E. Kloeze, H. Scholvinck, Y. Stienstra, C.L. Vermont, K.R. Wilting. HIV nurse consultants: A. Boonstra, H. de Groot-de Jonge, P.A. van der Meulen, D.A. de Weerd. HIV clinical virologists/chemists: H.G.M. Niesters, C.C. van Leer-Buter, M. Knoester. Universitair Medisch Centrum Utrecht, Utrecht: HIV treating physicians: A.I.M. Hoepelman*, J.E. Arends, R.E. Barth, A.H.W. Bruns, P.M. Ellerbroek, T. Mudrikova, J.J. Oosterheert, E.M. Schadd, M.W.M. Wassenberg, M.A.D. van Zoelen. HIV nurse consultants: K. Aarsman, D.H.M. van Elst-Laurijssen, E.E.B. van Oers-Hazelzet. Data collection: M. van Berkel. HIV clinical virologists/chemists: R. Schuurman, F. Verduyn-Lunel, A.M.J. Wensing. VUmc, Amsterdam: HIV treating physicians: E.J.G. Peters*, M.A. van Agtmael, M. Bomers, J. de Vocht. HIV nurse consultants: M. Heitmuller, L.M. Laan. HIV clinical virologists/chemists: C.W. Ang, R. van Houdt, A.M. Pettersson, C.M.J.E. Vandenbroucke-Grauls. Wilhelmina Kinderziekenhuis, UMCU, Utrecht: HIV treating physicians: S.P.M. Geelen, T.F.W. Wolfs, L.J. Bont. HIV nurse consultants: N. Nauta.

Coordinating Centre

Director: P. Reiss. Data analysis: D.O. Bezemer, A.I. van Sighem, C. Smit, F.W.M.N. Wit, T.S. Boender. Data management and quality control: S. Zaheri, M. Hillebregt, A. de Jong. Data monitoring: D. Bergsma, A. de Lang, S. Grivell, A. Jansen, M.J.

Rademaker, M. Raethke, R. Meijering, S. Schnörr. Data collection: L. de Groot, M. van den Akker, Y. Bakker, E. Claessen, A. El Berkaoui, J. Koops, E. Kruijine, C. Lodewijk, L. Munjishvili, B. Peeck, C. Ree, R. Regtop, Y. Ruijs, T. Rutkens, L. van de Sande, M. Schoorl, A. Timmerman, E. Tuijn, L. Veenenberg, S. van der Vliet, A. Wisse, T. Woudstra. Patient registration: B. Tuk.

CoRIS, Spain:

This work was supported by the Spanish Network of HIV/AIDS (RD12/0017/0018) and CIBER Epidemiología y Salud Pública (CIBERESP), Spain. J. del Amo, V. Hernando, A. Diaz: This article presents independent results and research. The views expressed are those of the authors and not necessarily those of the Instituto de Salud Carlos III.

Centers and investigators involved in CoRIS: Executive committee: Santiago Moreno, Julia del Amo, David Dalmau, Maria Luisa Navarro, Maria Isabel González, Jose Luis Blanco, Federico Garcia, Rafael Rubio, Jose Antonio Iribarren, Félix Gutiérrez, Francesc Vidal, Juan Berenguer, Juan González. Fieldwork, data management and analysis: Paz Sobrino, Victoria Hernando, Belén Alejos, Débora Álvarez, Inma Jarrín, Cristina Moreno. BioBanK HIV: M Ángeles Muñoz-Fernández, Isabel García-Merino, Coral Gómez Rico, Jorge Gallego de la Fuente y Almudena García Torre. Participating centres: Hospital General Universitario de Alicante (Alicante): Joaquín Portilla, Esperanza Merino, Sergio Reus, Vicente Boix, Livia Giner, Carmen Gadea, Irene Portilla, Maria Pampliega, Marcos Díez, Juan Carlos Rodríguez, Jose Sánchez-Payá. Hospital Universitari de Bellvitge (Hospitalet de Llobregat): Daniel Podzamczar, Elena Ferrerm Arkaitz Imaz, Evan Van Den Eynckle, Silvana Di Yacovo, Maria Sumoy. Hospital Universitario de Canarias (Santa Cruz de Tenerife): Juan Luis Gómez, Jehovana Hernández, María Remedios Alemán, María del Mar Alonso, María Inmaculada Hernández, Felicitas Díaz-Flores, Dácil García, Ricardo Pelazas. Hospital Universitario Central de Asturias (Oviedo): Victor Asensi, Eulalia Valle, José Antonio Cartón. Hospital Clínico San Carlos (Madrid): Vicente Estrada Pérez, Maria Jesus Téllez Molina, Jorge Vergas García, Elisa Pérez-Cecila Carrera. Hospital Doce de Octubre (Madrid): Rafael Rubio, Federico Pulido, Otilia Bisbal, Mariano Matarranz, Maria Lagarde, Rafael Rubio-Martín, Asunción Hernando, Laura Bermejo y Lourdes Dominguez. Hospital Universitario Donostia (San Sebastián): José Antonio Iribarren, Julio Arrizabalaga, María José Aramburu, Xabier Camino, Francisco Rodríguez-Arrondo, Miguel Ángel von Wichmann, Lidia Pascual Tomé, Miguel Ángel Goenaga, M^a Jesús Bustinduy, Harkaitz Azkune Galparsoro. Maialen Ibarguren, Mirian Aguado, Maitane Umerz. Hospital General Universitario de Elche (Elche): Félix Gutiérrez, Mar Masiá, Cristina López, Sergio Padilla, Andrés Navarro, Fernando Montolio, Catalina Robledano, Joan Gregori Colomé, Araceli Adsuar, Rafael Pascual, Federico Carlos, Maravillas Martinez,

Jara Llenas García, Marta Fernández, Elena García. Hospital Germans Trias i Pujol (Badalona): Roberto Muga, Jordi Tor, Arantza Sanvisens. Hospital General Universitario Gregorio Marañón (Madrid): Juan Berenguer, Juan Carlos López Bernaldo de Quirós, Pilar Miralles, Isabel Gutiérrez, Margarita Ramírez, Belén Padilla, Paloma Gijón, Ana Carrero, Teresa Aldamiz-Echevarría, Francisco Tejerina, Francisco Jose Parras, Pascual Balsalobre, Cristina Díez. Hospital Universitari de Tarragona Joan XXIII, IISPV, Universitat Rovira i Virgili (Tarragona): Francesc Vidal, Joaquín Peraire, Consuelo Viladés, Sergio Veloso, Montserrat Vargas, Miguel López-Dupla, Montserrat Olona, Alba Aguilar, Joan Josep Sirvent, Verónica Alba, Olga Calavia. Hospital Universitario La Fe (Valencia): Marta Montero, José Lacruz, Marino Blanes, Eva Calabuig, Sandra Cuellar, José López, Miguel Salavert. Hospital Universitario La Paz/IdiPaz (Madrid): Juan González, Ignacio Bernardino de la Serna, José Ramón Arribas, María Luisa Montes, Jose M^a Peña, Blanca Arribas, Juan Miguel Castro, Fco Javier Zamora, Ignacio Pérez, Miriam Estébanez, Silvia García, Marta Díaz, Natalia Stella Alcáriz, Jesús Mingorance, Dolores Montero, Alicia González, Maria Isabel de José. Hospital de la Princesa (Madrid): Ignacio de los Santos, Jesús Sanz, Ana Salas, Cristina Sarriá, Ana Gómez Berrocal, Lucio Garcia-Fraile. Hospital San Pedro-CIBIR (Logroño): José Antonio Oteo, José Ramón Blanco, Valvanera Ibarra, Luis Metola, Mercedes Sanz, Laura Pérez-Martínez. Hospital Universitario Miguel Servet (Zaragoza): Ascensión Pascual, Carlos Ramos, Piedad Arazo, Desiré Gil. Hospital Universitari Mutua de Terrassa (Terrassa): David Dalmau, Angels Jaén, Mireia Cairó, Daniel Irigoyen, Queralt Jordano, Mariona Xercavins, Javier Martinez-Lacasa, Pablo Velli, Roser Font, Montse Sanmartí, Laura Ibáñez. Complejo Hospitalario de Navarra (Pamplona): María Rivero, Marina Itziar Casado, Jorge Alberto Díaz, Javier Uriz, Jesús Repáraz, Carmen Irigoyen, María Jesús Arraiza. Hospital Parc Taulí (Sabadell): Ferrán Segura, María José Amengual, Gemma Navarro, Montserrat Sala, Manuel Cervantes, Valentín Pineda, Victor Segura, Marta Navarro, Esperanza Antón, M^a Merce Nogueras. Hospital Ramón y Cajal (Madrid): Santiago Moreno, José Luis Casado, Fernando Dronda, Ana Moreno, María Jesús Pérez Elías, Dolores López, Carolina Gutiérrez, Nadia Madrid, Angel Lamas, Paloma Martí, Alberto de Diaz, Sergio Serrrano, Lucas Donat. Hospital Reina Sofía (Murcia): Alfredo Cano, Enrique Bernal, Ángeles Muñoz. Hospital San Cecilio (Granada): Federico García, José Hernández, Alejandro Peña, Leopoldo Muñoz, Jorge Parra, Marta Alvarez, Natalia Chueca, Vicente Guillot, David Vinuesa, Jose Angel Fernández. Centro Sanitario Sandoval (Madrid): Jorge Del Romero, Carmen Rodríguez, Teresa Puerta, Juan Carlos Carrió, Mar Vera, Juan Ballesteros. Hospital de la Santa Creu i Sant Pau (Barcelona): Pere Domingo, M^a Antonia Sambeat, Karuna Lamarca, Gracia Mateo, Mar Gutiérrez, Irene Fernández. Hospital Universitario Santiago de Compostela (Santiago de Compostela): Antonio

Antela, Elena Losada. Hospital Son Espases (Palma de Mallorca): Melchor Riera, Maria Peñaranda, Maria Leyes, M^a Angels Ribas, Antoni A Campins, Carmen Vidal, Leire Gil, Francisco Fanjul, Carmen Marinescu. Hospital Universitari Vall d'Hebron (Barcelona): Esteban Ribera. Hospital Virgen de la Victoria (Málaga): Jesús Santos, Manuel Márquez, Isabel Viciano, Rosario Palacios, Isabel Pérez, Carmen Maria González. Hospital Universitario Virgen del Rocío (Sevilla): Pompeyo Viciano, Manuel Leal, Luis Fernando López-Cortés, Nuria Espinosa. Hospital Universitario de Basurto (Bilbao): Josefa Muñoz, Miren Zuriñe Zubero, Josu Mirena Baraia-Etxaburu, Sofia Ibarra, Oscar Ferrero, Josefina López de Munain, M^a Mar Cámara. Iñigo López, Mireia de la Peña. Hospital Universitario Infanta Sofia (San Sebastián de los Reyes): Inés Suárez-García, Eduardo Malmierca. Hospital Universitario Costa del Sol (Marbella): Julián Olalla, Alfonso del Arco, Javier de la torre, José Luis Prada, Zaira Caracuel. Hospital del Poniente (El Ejido): Ana Maria Lopez-Lirola, Ana Belén Lozano, Elisa Fernández, Inés Pérez, Juan Manuel Fernández. Hospital Universitario Santa Lucia (Cartagena): Onofre Juan Martínez, Francisco Jesús Vera, Lorena Martínez, Josefina García, Begoña Alcaraz, Amaya Jimeno. INIBIC-Complejo Hospitalario Universitario de A Coruña (A Coruña): Eva Poveda, Berta Pernas, Álvaro Mena, Marta Grandal, Ángeles Castro, José D. Pedreira. Hospital Clínico Universitario Virgen de la Arrixaca (Murcia): Carlos Galera, Helena Albendin, Asunción Iborra, Antonio Moreno, Maria Angeles Campillo, Asunción Vidal. Hospital Marina Baixa (Villajoyosa): Concha Amador, Francisco Pasquau, Javier Ena, Concha Benito, Vicenta Fenoll. Complejo Hospitalario de Jaén (Jaén): Mohamed Omar Mohamed-Balghata, Maria Amparo Gómez. Hospital San Agustín de Aviles (Avilés): Miguel Alberto de Zarraga, Maria Eugenia Rivas. Fundación Jiménez Diaz (Madrid): Miguel Górgolas.

InfCare HIV, Sweden:

The InfCare HIV cohort is funded by the Swedish Association of Local Authorities and Regions, and by the Swedish HIV clinics. InfCare HIV Steering Committee: Anders Sönnernborg (director), Veronica Svedhem-Johansson, Leo Flamholz, Magnus Gisslén, Bo Hejdeman, Hans Norgren, Suzanne Wendahl. InfCare HIV participating centres: Karolinska University Hospital, South Hospital, Sahlgrenska University Hospital, Skane University Hospital, Borås Hospital, Eskilstuna Hospital, Falun Hospital, Gävle Hospital, Halmstad Hospital, Helsingborg Hospital, Kalmar Hospital, Karlskrona Hospital, Karlstad Hospital, Kristianstad Hospital, Linköping University Hospital, Ryhov County Hospital, Skövde Hospital, Sundsvall Hospital, Sunderbyn Hospital, Trollhättan Hospital, Uppsala University Hospital, University Hospital of Umeå, Visby Hospital, Västerås Central Hospital, Växjö Hospital, Örebro University Hospital, Östersund Hospital.

UK Collaborative HIV Cohort Study:

UK CHIC is funded by the UK Medical Research Council (grant numbers G0000199, G0600337, G0900274, and M004236). The views expressed in this manuscript are those of the researchers and not necessarily those of the Medical Research Council.

UK CHIC Steering Committee: Jonathan Ainsworth, Sris Allan, Jane Anderson, Abdel Babiker, David Chadwick, Valerie Delpech, David Dunn, Martin Fisher, Brian Gazzard, Richard Gilson, Mark Gompels, Phillip Hay, Teresa Hill, Margaret Johnson, Sophie Jose, Stephen Kegg, Clifford Leen, Fabiola Martin, Mark Nelson, Chloe Orkin, Adrian Palfreeman, Andrew Phillips, Deenan Pillay, Frank Post, Jillian Pritchard, Caroline Sabin, Memory Sachikonye, Achim Schwenk, Anjum Tariq, Roy Trevelion, John Walsh.

UK CHIC Central Co-ordination: University College London (Teresa Hill, Sophie Jose, Andrew Phillips, Caroline Sabin); Medical Research Council Clinical Trials Unit at UCL (MRC CTU at UCL), London (David Dunn, Adam Glabay).

UK CHIC Participating Centres: Brighton and Sussex University Hospitals NHS Trust (M Fisher, N Perry, S Tilbury, E Youssef, D Churchill); Chelsea and Westminster Hospital NHS Foundation Trust, London (B Gazzard, M Nelson, R Everett, D Asboe, S Mandalia); King's College Hospital NHS Foundation Trust, London (F Post, H Korat, C Taylor, Z Gleisner, F Ibrahim, L Campbell); Mortimer Market Centre, University College London (R Gilson, N Brima, I Williams); Royal Free NHS Foundation Trust/University College London (M Johnson, M Youle, F Lampe, C Smith, R Tsintas, C Chaloner, S Hutchinson, C Sabin, A Phillips, T Hill, S Jose, A Thornton, S Huntington); Imperial College Healthcare NHS Trust, London (J Walsh, N Mackie, A Winston, J Weber, F Ramzan, M Carder); Barts and The London NHS Trust, London (C Orkin, J Lynch, J Hand, C de Souza); Homerton University Hospital NHS Trust, London (J Anderson, S Munshi); North Middlesex University Hospital NHS Trust, London (J Ainsworth, A Schwenk, S Miller, C Wood); The Lothian University Hospitals NHS Trust, Edinburgh (C Leen, A Wilson, S Morris); North Bristol NHS Trust (M Gompels, S Allan); Leicester, University Hospitals of Leicester NHS Trust (A Palfreeman, K Memon, A Lewszuk); Middlesbrough, South Tees Hospitals NHS Foundation Trust (D Chadwick, E Cope, J Gibson); Woolwich, Lewisham and Greenwich NHS Trust (S Kegg, P Main, Dr Mitchell, Dr Hunter), St George's Healthcare NHS Trust (P Hay, M Dhillon); York Teaching Hospital NHS Foundation Trust (F Martin, S Russell-Sharpe); Coventry, University Hospitals Coventry and Warwickshire NHS Trust (S Allan, A Harte, S Clay); Wolverhampton, The Royal Wolverhampton Hospitals NHS Trust (A Tariq, H Spencer, R Jones); Chertsey, Ashford and St Peter's Hospitals NHS Foundation Trust (J Pritchard, S Cumming, C Atkinson); Public Health England, London (V Delpech); UK Community Advisory Board (R Trevelion).